

STUDY

A Day at the Beach While on Tropical Vacation

Sun Protection Practices in a High-Risk Setting for UV Radiation Exposure

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Objective: To conduct an assessment of levels of UV radiation (UVR) exposure and the range of sun protection behaviors of beachgoers at a popular vacation destination.

Design: Participants completed the sun habits survey prior to entry to the beach and completed an exit survey on leaving regarding their sun protection practices while at the beach. Ambient UVR was monitored using polysulfone dosimeters.

Setting: A popular beach for vacationers in Honolulu, Hawaii.

Main Outcome Measures: Sun protection practices and UVR.

Results: Participants spent an average of 3 hours at the beach and received an estimated UVR dose of 10.4 standard erythemal doses. Latent class analysis identified 3 homogeneous classes with distinct characteristics and sun protection behaviors. Those in class 1 (unconcerned and

at low risk) were at least risk of skin cancer, intended to tan, and used the least amount of sun protection. Those in class 2 (tan seekers) had the second highest risk of skin cancer, had the highest proportion of women, became sunburned easily, intended to tan, had used tanning beds in past 30 days, and had the highest proportion of sunscreen coverage and the least clothing coverage. Those in class 3 (concerned and protected) had the highest skin cancer risk, the highest proportion of clothing coverage and shade use, and were more likely to be residents of Hawaii.

Conclusions: Beachgoers were exposed to 5 times the UVR dose required to result in erythema among unprotected fair-skinned populations. Latent class analysis was effective in identifying subgroups of beachgoers who would benefit from targeted, population-based interventions aimed at reducing skin cancer risks while enjoying outdoor leisure-time activities.

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IN THE UNITED STATES, SKIN CANCER incidence and mortality, particularly cutaneous melanoma, attributable to outdoor exposure to UV radiation (UVR) has increased rapidly in the past 3 decades.^{1,2} Behavioral recommendations for the prevention of skin cancer aim to reduce exposure to UVR by limiting time spent in the sun,

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seeking shade during periods of peak UVR, using a sunscreen with a sun protection factor (SPF) of 15 or higher, wearing protective clothing (hat, shirt, pants) and sunglasses, and making sun safety a regular habit.³ The US Department of Health and Human Services Health Objectives for the year 2010 include these recommendations.⁴

Frequent, intermittent overexposure to UVR, such as that obtained during outdoor recreation activities or vacations at sunny locations, has been reported to result in notable increases in the development of basal cell carcinoma⁵ and melanoma.⁶⁻⁹ Adults and adolescents are particularly at risk for intense, episodic sun exposure while on vacation or in "high-risk" environments such as beaches.^{10,11} Tropical vacations represent not only the potential for high levels of UVR exposure because of location but also because "sun-intense" activities are preferred¹² and vacationers plan to suntan¹³ and are prepared to become sunburned in the process.¹⁴ It has been estimated that a 3-week vacation to Hawaii has the potential to double an individual's annual dose of UVR.¹⁵ We conducted a multimeasure assessment of levels of UVR exposure and the range of sun protection behaviors of

beachgoers at a popular vacation destination. Although previous research has described the frequency of sun safety behaviors used, we examined how individuals practiced sun safety in this high-risk setting considering their constitutional risk for skin cancer and intention to tan.

METHODS

SETTING

The setting for this study was a beach in Honolulu, Hawaii, that is popular for swimming and snorkeling and attracts approximately 2500 visitors a day. This setting was chosen because the entrance and exit for the beach are limited to 1 location, providing an ideal opportunity to recruit participants and reduce attrition.

PROCEDURE

Data collection was undertaken over 3 days during February and March 2004 and has been described previously.¹⁶ Briefly, participants were recruited while waiting in line for admittance to the beach. Our goal was to recruit 30 people a day for 3 days. We commenced recruitment at 8 AM, and our last person was recruited around 2 PM on each day. At 15-minute intervals, approximately every sixth person was approached, alternating between males and females and allowing only 1 person from each group or family to participate. A total of 130 people were approached to be involved and 90 consented, resulting in a recruitment rate of 70.3%. Once consent was obtained, participants completed the "Sun Habits Survey," which took approximately 5 minutes. On leaving the beach, they completed an exit survey of their sun protection practices while at the beach and were given a small gift in appreciation for being involved. All procedures were approved by the committee for human subjects at the University of Hawaii at Manoa.

INSTRUMENTS

A Sun Habits Survey was completed on entry to the beach and required participants to respond to a range of items related to UVR exposure and sun protection practices. Items included demographic information such as sex, date of birth, level of education, ethnicity, and place of residence. Participants were asked to report on their use of sunscreen prior to coming to the beach and where applied (face and nose, ears, neck and shoulders, back, arms, thighs and upper knees, and chest and stomach). Participants were also asked to report on the color of their skin as a result of the sun within the past 48 hours, use of a tanning salon in the past month, and their intention to acquire a tan while on the beach that day.

The Sun Habits Exit Survey required participants to report on their UVR exposure and sun protection behaviors while at the beach. Items included time spent at the beach, use of shade, time spent in shade, and time spent in the water. Participants were also asked about the type of clothing most often worn while on the beach and when in the water, and the survey addressed the type of clothing worn on the upper body (nothing, bikini top, 1-piece swimsuit, tank top, short- or long-sleeved shirt), lower body (bikini bottom, men's swimming brief, shorts, skirt, pants), type of footwear (slippers, sandals, shoes, or sneakers), head wear (nothing, cap, brimmed or legionnaire-type hat), and sunglasses (yes or no). Participants were also asked about their use of sunscreen while at the beach and where it was applied (face and nose, ears, neck and shoulders, back, arms, thighs and upper knees, and chest and stomach). Finally, partici-

pants were asked, "How much sun do you think you received while at the beach today? Enough to cause your skin to not change color, tan a little, tan a lot, turn pink, or turn red?" Overall, items pertaining to amount of time spent outside, clothing worn, and sunscreen use demonstrated good criterion validity when compared with direct observation and sunscreen swabbing samples.¹⁶

Skin cancer risk was assessed using the Brief Skin Cancer Risk Assessment Tool (BRAT),¹⁷ which includes questions about subjects' propensity to sunburn, skin color, hair color, number of moles and freckles, where they lived most of their childhood, and their history of severe sunburns and skin cancer. Questions about phenotypic characteristics were asked on the Sun Habits Survey, and questions pertaining to history of sunburn and skin cancer were asked on the Sun Habits Exit Survey. The BRAT items are weighted based on the epidemiologic literature and used to categorize participants into low-, moderate-, or high-risk groups.

Polysulfone dosimeters were used to monitor levels of ambient UVR at the beach from 8 AM to 4 PM on each day of data collection. Polysulfone dosimeters that are used for the measurement of ambient UVR should not exceed a level of absorbance of 0.5 to provide accurate readings.^{18,19} Therefore, 2 polysulfone badges were simultaneously exposed and replaced every hour and then placed in a light-proof envelope to prevent further photodegradation.

DATA PREPARATION

Polysulfone dosimeters were calibrated prior to field use, using a standard protocol developed and conducted by the Australian Radiation Protection and Nuclear Safety Agency. This procedure has been reported in previous research measuring ambient and personal UVR exposure¹⁸⁻²⁰ that provides an erythemally effective dose in a reading of joules per meters squared.¹⁹ This reading was then converted to standard erythemal dose (SED) units, which is equivalent to 100 J/m².²¹ Two polysulfone dosimeters were used at each interval to serve as a reliability check and were correlated at $r=0.99$. The mean of the 2 readings was used for further analyses.

Personal UVR exposure was calculated from researcher observations of participant arrival and departure from the beach (excluding the time they reported using shade) and ambient UVR recorded using the polysulfone dosimeters during that time. This provided an estimated UVR dose that each individual could have received while in the sun at the beach and is reported in SED units, not accounting for personal sun protection afforded by sunscreen or clothing.

Individual sun protection practices reported in the exit survey were dichotomized for use in bivariate analysis. "Hat use" was recoded to classify the use of any type of hat (yes indicated a cap or a brimmed or legionnaire-type hat, and no indicated no headwear). Upper-body clothing was recoded from 6 categories to identify the use of a shirt with sleeves (yes indicated a short- or long-sleeved shirt, and no indicated none or a bikini top, 1-piece swimsuit, or tank top). Lower-body clothing was recoded from 4 categories to identify use of "shorts/skirt" (yes indicated shorts or skirt, and no indicated a bikini bottom or men's swimming brief). Footwear was recoded from 4 categories to identify any use of footwear (yes indicated slippers, sandals, shoes, or sneakers, and none indicated no footwear). The use of sunglasses (yes or no) remained unchanged.

The clothing coverage index was calculated from individuals' reported use of clothing worn while on the beach and in the water. The clothing coverage index provides an estimate of the percentage of the body covered by clothing and has been described previously.^{22,23} A total of 17 separate body segments

were identified, and whether each was covered or not was determined by the exit survey under shorts or skirt use, sleeve length, or hat use. Each segment was weighted according to percentage of the total body surface area it occupied on a person of average proportions and assuming standard coverage for like articles of clothing (eg, 26.4% coverage for all shorts or skirts). The weighted scores were then summed to give an index of the proportion of the body covered by clothing.²³

The sunscreen coverage index provided an estimate of the percentage of the body covered by sunscreen excluding that already covered by clothing. Using a procedure similar to that used to calculate the clothing coverage index, an estimate of sunscreen coverage at each anatomical site was applied: face and nose, 4.0%; ears, 1.5%; neck and shoulders, 7.1%; back, 12.0%; arms (excluding hands), 10.8%; thighs and upper knees, 14.4; and chest and stomach, 12.0%. For each anatomical site for which sunscreen use was reported, the percentage of coverage by clothing was then subtracted. For example, if an individual reported applying sunscreen to his or her arm and wore a short-sleeved shirt, the initial estimate of sunscreen use would have been 10.8% – 3.6% for coverage by the short sleeves, resulting in sunscreen coverage score on the arm of 7.2%. A similar approach was adopted for all clothing sites. Reported hat and sunglass use were not included in the development of this index.

The BRAT was used to categorize participants into low-, moderate-, or high-risk groups based on previously established cut-off points.¹⁷ The BRAT scores ranged from 4 to 68; individuals scoring 26 or lower were categorized as a “low risk,” those with scores of 27 to 35 were considered “moderate risk,” and those with scores of 36 or higher were classified as “high risk.”

STATISTICAL ANALYSIS

Descriptive statistics (frequencies, means [SDs]) were used to examine the distribution of the measures; χ^2 was used to test for bivariate associations between categorical variables, and Wilcoxon, Kruskal-Wallis; and *F* tests were used for associations between categorical and continuous variables using SAS statistical software (version 9.1; SAS Inc, Cary, North Carolina). Latent class analysis (LCA) was used to explore the data for homogeneous subgroups of individuals on the basis of their constitutional risk (BRAT risk category), intention to tan, and pattern of sun protection behavior (shade use, clothing coverage, and sunscreen coverage) adjusting for age, white race (yes or no), and sex. Mplus software (version 4.1; Muthén & Muthén, Los Angeles, California) was used to conduct the LCA, which provides a person-centered approach that enables grouping of individuals who are similar to each other and different from other groups.²⁴ The LCA allows for continuous, ordinal, and categorical independent variables and adjustment for covariates.²⁴ Individuals are assigned to one of “ κ ” classes based on the independent variables by maximum likelihood. Models with 2, 3, and 4 classes were assessed using the Lo-Mendell-Rubin (LMR) adjusted likelihood ratio test and entropy (range, 0-1), which tests the adequacy of the number of classes and how well the classes can be distinguished, respectively.²⁴ Classes, assigned by posterior probabilities, were tested further to see if they differ on behaviors and outcomes such as tanning bed use and recent tanning or sunburn using χ^2 and *F* tests.

RESULTS

PARTICIPANT CHARACTERISTICS

Participant characteristics have been reported previously.¹⁶ In short, 88 participants were evenly distrib-

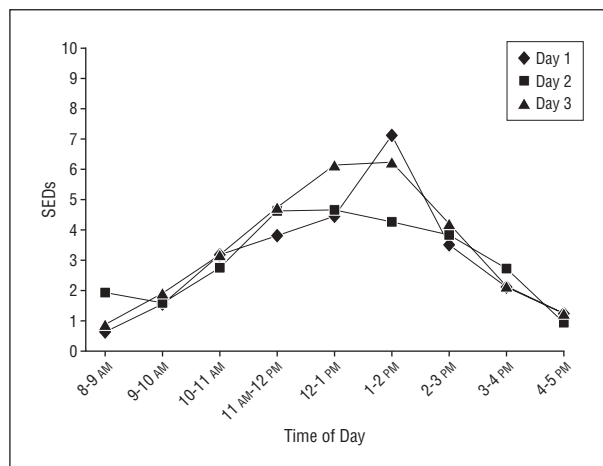


Figure. Amount of ambient UV radiation recorded during data collection. SEDs indicates standard erythemal doses.

uted between males (51%) and females. Their mean (SD) age was 40 (13.8) years (range, 19-74 years), 68 (77%) were white, and 40 (47%) reported having at least a college degree. Most participants (*n*=75 [86%]) reported being on vacation. Participants spent a mean (SD) time of 2.7 (1.06) hours at the beach (range, 0.37-4.92 hours). Based on the items for the BRAT, 34% (*n*=29) of the sample was categorized as low risk; 44% as moderate risk (*n*=38), and 22% as high risk (*n*=19) (based on a total of 86 participants; some data were missing). Sex differences were few in this sample of beachgoers. There were proportionally more white males in this sample (*n*=38 [84%]) compared with white females (*n*=30 [70%]), although this trend did not reach statistical significance (*P*=.10); BRAT risk groups were not statistically significant by sex (*P*=.16). There were no significant sex differences by intention to tan (*P*=.78) and in sun protection behaviors of shade use (*P*=.90), total sunscreen coverage (*P*=.90), and wearing a hat (*P*=.58) and sunglasses (*P*=.62). Clothing coverage was greater for males owing, in part, to the fact that most males wore shorts; also, there were proportionally more males ($\chi^2_1=6.0$; *P*=.01) who reported wearing a shirt with sleeves while on the beach (*n*=12 [27%]) compared with females (*n*=3 [7.1%]).

UVR EXPOSURE

The **Figure** displays the levels of ambient UVR for the 3 days of data collection monitored from 8 AM to 5 PM. A total of 29.6 SEDs were recorded on day 1, with 26.5 SEDs on day 2 and 30.6 SEDs on day 3. The mean (SD) amount of personal UVR exposure that individuals received while in full sun was 10.4 (5.8) SEDs (range, 0.0-24.6 SEDs; median=9.1 SEDs). Seven individuals (9%) who reported spending 2 to 3 hours in the water received a significantly (*F*₂=3.8; *P*=.03) higher level of exposure (mean exposure, 14.8 SEDs; 95% confidence interval [CI], 10.0-20.3) compared with 33 individuals (40%) who spent 1 to 2 hours in the water (mean exposure, 11.2 SEDs; 95% CI, 9.5-12.9) or the majority (42 participants [51%]) who reported spending less than 1 hour in the water (mean-

exposure, 9.0 SEDs; 95% CI, 7.1-10.9). Individuals who reported that they planned to tan while at the beach received significantly higher levels ($F_1=13.3$; $P<.001$) of UVR exposure (11.8 SEDs; 95% CI, 10.3-13.2) than those who had no intentions of tanning (7.0 SEDs; 95% CI, 4.7-9.2).

There were no significant differences in the level of UVR exposure received by individuals based on demographic characteristics such as age ($P=.11$), residence ($P=.71$), sex ($P=.84$), ethnicity ($P=.42$), education ($P=.90$), and skin cancer risk (BRAT) ($P=.47$). Personal UVR exposure was calculated to exclude time reported in shade, and persons using shade did not differ in the amount of time at the beach compared with those who did not (data not shown). Almost 23% of participants (20) reported using shade while at the beach, although most (65% [13]) used it for less than 1 hour. Therefore, it is not surprising that individuals reporting shade use while at the beach received significantly less UVR exposure (6.5 SEDs; 95% CI, 3.9-9.0) compared with those who did not report using shade (11.5 SEDs; 95% CI, 10.2-12.9). Furthermore, the amount of time spent under shade was significantly associated with levels of personal UVR exposure, with those reporting no shade use receiving significantly higher levels of UVR exposure ($F_2=9.9$; $P<.001$) than those who spent less than 1 hour under shade (7.5 SEDs; 95% CI, 5.2-9.8) or 1 or more hours under shade (4.5 SEDs; 95% CI, 0.8-8.2). No other sun protection behaviors (clothing, hat, sunglasses, or sunscreen) were associated with the personal UVR exposure measure, although it would be expected that such behaviors would reduce the negative effects of personal exposure.

LATENT CLASS ANALYSIS

Latent class models were evaluated for $k=2$ -, 3-, and 4-class solutions to identify subgroups of participants who have similar patterns concerning sun protection and constitutional risk (where k is the number of classes requested). The 2-class solution had good entropy (0.96), with a significantly better fit than the 1-class solution (LMR test, 85; $P<.001$); however, the 3-class solution was superior to the 2-class solution (entropy, 0.97; LMR test, 66; $P=.002$). The 4-class solution was identical to the 3-class solution in grouping the participants, except that 1 individual in the best protected class was put into a class of his own, thus creating an unstable solution. No further models were tested. Class membership, assigned via posterior probabilities, was used to determine how classes differed on the covariates, derivation variables, and other related measures and outcomes (Table).

The ordering of classes was arranged such that the highest number represents the most or most effective sun protection behaviors. All derivation variables were important in distinguishing the classes; thus, they show significant differences (see the Table for P values). Age, a covariate, showed a marginal difference between classes, with the most protected class having the oldest mean age. The derivation variables included indices calculated from clothing worn on the beach, sunscreen use, and consti-

tutional risk indicators. Components of these indices were also tested to describe the differences between classes. The color of untanned skin did not differ by class, but the self-description "sunburn easily" did. Sun protection habits of sunscreen total coverage and wearing a shirt with sleeves and shorts all differed, whereas hat use did not. Other variables unrelated to class derivation differed by class (Hawaii resident, skin color change owing to the day's sun exposure, shirt with sleeves worn in the water), others showed trends (time spent in the water, sunscreen SPF level, and tanning salon use), and some were not apparently related to class (concern about sunburn, SED, a sunburn in the past 48 hours, use of sunglasses).

The classes are as follows. Class 1 comprised those who were unconcerned and at lower risk, which includes 24% (21 subjects) of this sample, represents a group (11 were male [52%], 71 were white [81%]) who used the least amount of sunscreen and less clothing, used shade the least, intended to tan, and had the fewest members with a high risk of developing skin cancer. Most (15 subjects [71.4%]) did not sunburn easily, 5 (24%) had used a tanning salon within the past month, and 20 (95%) intended to tan. Class 2 comprised tan seekers (47 subjects [55%]) and had the highest proportion of females (26 [55%]), a high proportion of white individuals (37 [79%]), and the highest number who reported that they sunburn easily (30 [67%]). They used the most sunscreen coverage and the least clothing coverage, their use of shade was intermediate among the classes (9 [19%]), and most (34 [76%]) intended to tan. This group comprised mostly visitors to Hawaii (44 subjects [94%]), and they had the most tanning salon use (14 [30%]) and the highest rate of sunburn in the past 48 hours (20 [44%]). Class 3 comprised subjects who were concerned about UVR and were protected (18 subjects [21%]; 13 [72%] were male, and 12 [67%] were white), was the most careful group with the most clothing coverage and shade use and had the lowest proportion (5 subjects [28%]) with an intention to tan. Most (9 subjects [60%]) even wore shirts with sleeves into the water. This group included the highest proportion with a high risk for skin cancer (6 subjects [33%]) as well as the highest proportion at low risk (9 [50%]), the most residents of Hawaii (6 [33%]), and those with the most concern about painful sunburn (4 [25%]).

COMMENT

During their time at the beach at the beach (mean time, 3 hours), most participants were exposed to some 10 SEDs of UVR, equivalent to 5 times the UVR dose required to result in erythema among unprotected fair-skinned populations. Approximately 60 subjects (70%) went to the beach with an intention to tan, despite 32 (40%) reporting they had obtained a sunburn in the previous 48 hours. Of those sunburned in the previous 48 hours, 14 (44%) reported being sunburned again on the day of data collection. Furthermore, almost 23% of participants (20) reported attending a tanning salon in the past 30 days. These findings add credence to previous research stating that

Table. Latent Class Associations With Behavioral Outcomes and Attitudes^a

Characteristic	Total Sample (n=88) ^b	Class			P Value
		1 (n=21)	2 (n=47)	3 (n=18)	
Covariates					
Age, mean (SD), y	39.5 (13.8)	41.6 (14.2)	36.3 (12.5)	45.4 (14.7)	.054
White race	77	81	79	67	.55
Male	51	52	45	72	.15
Derivation variables					
Sunscreen coverage index, mean (SD)	31 (24)	6 (9)	51 (10)	9 (8)	<.001
Clothing coverage index, mean (SD)	34 (18)	27 (10)	27 (10)	64 (8)	<.001
Intent to tan	70	95	76	28	<.001
Use of shade	23	10	19	44	.03
High constitutional risk, %	22	14	22	33	.03
Descriptive measures					
Personal characteristics					
Hawaii resident	15	19	6	33	.02
Fair or very fair untanned skin ^c	77	81	80	61	.26
Sunburns easily ^c	51	29	67	39	.01
Concern about painful sunburn (somewhat/extremely), % ^d	14	5	15	25	.24
Sun exposure and protection					
Personal UVR exposure, mean (SD), SED	10 (6)	13 (6)	10 (5)	9 (7)	.21
Spent >1 h in water	50	52	55	28	.14
Hat worn on beach ^c	31	28	28	50	.18
Sleeves worn on the beach ^c	62	0	0	88	<.001
Sleeves worn in the water	12	5	0	60	<.001
Shorts or more worn on the beach ^c	59	58	44	100	<.001
Sunglasses worn on the beach	59	61	59	64	.95
Sunscreen total coverage, mean (SD) ^c	40 (25)	9 (17)	57 (8)	32 (23)	<.001
Sunscreen with SPF ≥30 ^e	73	50	70	100	.11
Tanning behavior					
Tanning salon use in past month	23	24	30	6	.11
Sunburn in past 48 h	37	29	44	28	.38
Skin color change today (those who replied yes), %	84	91	89	59	.02

Abbreviations: SED, standard erythemal dose; SPF, sun protection factor; UVR, UV radiation.

^aData are given as percentages except where indicated.

^bThe sample size differs owing to missing values.

^cUsed in the creation of derivation variable indices.

^dOn a 5-point scale from 1 (not at all concerned) to 5 (extremely concerned).

^eAmong those reporting use of that protection habit.

vacationers to tropical locations intend to tan¹³ and are prepared to become sunburned in the process.¹⁴ These alarmingly high levels of UVR highlight an urgent research priority, one that should be focused on providing a careful balance between reducing harmful intense exposures to UVR while simultaneously promoting the outdoor activities that many vacationers have traveled to sunny locations to enjoy. This is particularly relevant because cancer prevention organizations are now actively promoting the preventive benefits of physical activities, which have the potential to conflict with sun protection messages.²⁵

Latent class analysis provides a person-centered approach that enables grouping of individuals who are similar to each other and different from other groups.²⁴ This analytical approach was used previously to ascertain whether at-risk individuals were heterogeneous with regard to risk and "usual" sun protection behavior and found that male classes differed only in their use of sunscreen, and females classes showed a continuum of sun protection vigilance with no distinct differences in their pattern of habits.²⁶ In this study, assessment of persons in a high-risk setting allowed us to examine how the sun protection

habits are used together in combination with constitutional risk and a motivation to tan, albeit not in a usual setting for most participants. Those in class 1 (unconcerned and at lower risk) were a less protected group who wore little sunscreen or clothing, had minimal use of shade, and were less likely to sunburn. Those in the most conscientious group (class 3, concerned and protected) were well covered by clothing, even wearing shirts with sleeves in the water, used shade, had the highest proportion at high (and low) risk, and were most concerned about obtaining a painful sunburn. Those in class 2 (tan seekers) were visitors to Hawaii, intent on tanning while at the beach regardless of the fact that they sunburned easily, had obtained a sunburn in the past 48 hours, and almost 30% (14) had used a tanning bed in the past 30 days. In terms of sun protection, those in class 2 had a greater reliance on the use of sunscreen than on clothing coverage and used little shade. Those in class 2 are an important group to identify, and their desire to tan and their reliance on sunscreen are important considerations for intervention strategies. Although different variables were used to identify population subgroups, these findings are very similar to those identified

by Pagoto et al.¹¹ Although our study did not identify a subgroup that had little interest in tanning and a low skin cancer risk, both studies identified a subgroup that could be identified as “sun worshippers” with moderate risk. More information is required regarding the tanning motivations of this population subgroup in the current study. Interventions that emphasize the detrimental appearance-related aspects (erythema and premature aging), including the provision of appropriate alternatives,²⁷ coupled with strategies that target the health-related risks associated with intense doses of UVR exposure (skin cancers) may prove efficacious.

Further research is required to establish the motivations behind the willingness to get repeated sunburns while on vacation for a group of individuals who sunburn easily. Population-based interventions, specifically those targeting the beach-going public, may be most efficacious in targeting the risk-taking behaviors of those in class 2, with the aim of reducing the amounts of UVR they receive through improved sun protection practices. Although we are unable to determine if this group of participants used sunscreen as a tanning aid²⁸ or to protect themselves because of the sunburn they received over the past 2 days, it is an important issue to elucidate in future studies involving similar populations. Nearly one-quarter of the beachgoers reported using a tanning bed in the past 30 days. Although the motivation regarding the use of tanning beds could not be determined in this study, it has been reported that tanning beds have been used to develop a “base tan” prior to vacations to sunny locations.^{29,30} This practice is not protective, provides little defense against subsequent exposure, and may be cumulatively more damaging to the skin.³¹

Few public health programs have addressed the challenging problem of reducing the levels of sun exposure obtained by vacationers traveling to tropical destinations. Prior approaches have been in the form of brief, knowledge-based strategies, such as brochures disseminated through the airlines.^{32,33} Not surprisingly, these “one-shot” strategies did not reduce the levels of reported sunburn among vacationers.^{32,33} However, these approaches may be a useful adjunct to a more comprehensive program implemented at the vacation destination.³³

Interpretation of these findings should be tempered by the following limitations. Because of a small sample size, our findings, including the latent class categorization, may not be generalizable to all beachgoers. Furthermore, this study assessed beach habits of individuals for only 1 day and may not be reflective of their usual sun protection practices. All measures relied on self-report, which has the potential for inaccuracy owing to poor recall, difficulty estimating the frequency of routine behaviors, and social demand biases.³⁴ However, given the short recall period and the high proportions of detrimental health behavior (ie, sunburn), these may be a relatively accurate indication of behavior. Furthermore, all measures demonstrated good criterion validity when compared with direct observation and sunscreen swabbing samples.¹⁶ Finally, we did not quantify the UVR levels under natural or built shade structures, which limited our ability to estimate personal UVR exposure as a

result of shade use. Although the use of shade would have the potential to reduce the levels of UVR exposure individuals received, there would have been great variability depending on the type of structure and the attenuation of the sun.³⁵

Findings from this study indicate that the beach is an ideal setting to initiate a program aimed at promoting sun-safe practices while enjoying the many activities that a day at the beach has to offer. Collaborative efforts with key stakeholders such as local government, the tourist industry, local business, and community representatives should examine a broad range of strategies—not just targeting individual behavior change, but also the environment—to promote the reduction of intense UVR exposures among beachgoers. Specific strategies should target the subsets of the beach-going population (particularly those in group 2—the tan seekers) that intend to tan and sunburn repeatedly, taking into account their relevant personal attributes and behavior patterns. A balance should be provided between messages that focus on the immediate detrimental effects (photoaging, soreness)³⁶ as well as the long-term detrimental health effects (skin cancer) of excessive UVR exposure, all the time balancing the health interests of the public with the needs of local industry. It is important that further research is undertaken to confirm these findings among a broader range of geographic locations, including diverse populations, and to initiate trials of multilevel sun protection programs to address this area of concern.

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